

What is claimed is

1. A method for monitoring the health of a system, which comprises performing at each of a plurality of times the
5 steps of:
- constructing a condition signature from a plurality of condition indicators including (a) a plurality of vibration measurements acquired from said system or (b) one or more vibration measurements and one or more performance
10 parameter measurements acquired from said system;
- predicting a normal signature from a model defining one or more inter-dependencies between said condition indicators, said normal signature corresponding to a condition signature for a healthy system;
- 15 comparing said condition signature with said normal signature; and
- registering an event if said condition signature differs from said normal signature by more than a predetermined threshold.
- 20
2. A method according to claim 1, wherein said model is a learnt model.
3. A method according to claim 1, wherein said model
25 comprises a matrix with one or more non-zero off-diagonal terms to define said interdependencies.
4. A method according to claim 3, wherein the step of comparing said condition signature with said normal
30 signature involves calculating a value for the normalised innovations squared.
5. A method according to claim 1, wherein said model comprises a neural network.

6. A method according to claim 5, wherein the step of comparing said condition signature with said normal signature involves calculating a prediction error.

5

7. A method according to claim 1, wherein said times define successive intervals of at most 1 sec duration.

8. A method for monitoring the health of a system, which comprises performing at each of a plurality of times defining successive intervals of at most 1 sec duration the steps of:

constructing a condition signature from a plurality of condition indicators including (a) a plurality of vibration measurements acquired from the system or (b) one or more vibration measurements and one or more performance parameter measurements acquired from said system;

predicting a normal signature corresponding to a condition signature for a healthy system;

comparing said condition signature with said normal signature; and

registering an event if said condition signature differs from said normal signature by more than a predetermined threshold.

25

9. A method according to claim 8, wherein said normal signature is predicted from a model defining one or more inter-dependencies between said condition indicators

10. A method according to claim 9, wherein said model is a learnt model.

11. A method according to claim 9, wherein said model comprises a matrix with one or more non-zero off-diagonal

T05070"80085350

terms to define said interdependencies.

12. A method according to claim 11, wherein the step of
 comparing said condition signature with said normal
 5 signature involves calculating a value for the normalised
 innovations squared.

13. A method according to claim 9, wherein said model
 comprises a neural network.

10

14. A method according to claim 13, wherein the step of
 comparing said condition signature with said normal
 signature involves calculating a prediction error.

15 15. A method according to any one of claims 1 to 14,
 wherein said measurements are synchronously acquired from
 said system to a synchronisation imprecision of at most 1
 sec.

20 16. A method according to any one of claims 1 to 14,
 wherein said system comprises a gas turbine engine.

17. A data processing system for monitoring the health of
 a system, comprising:

25 data acquisition means for acquiring a plurality of
 condition indicators from said system at each of a
 plurality of times, said condition indicators including (a)
 a plurality of vibration measurements or (b) one or more
 vibration measurements and one or more performance
 30 parameter measurements;

processor means for constructing a condition signature
 from said condition indicators and for predicting a normal
 signature corresponding to a condition signature for a
 healthy system, said normal signature being predicted by a

09898008 070501

model which defines one or more inter-dependencies between said condition indicators;

comparator means for comparing said condition signature with said normal signature; and

5 registration means for registering an event if said comparator indicates that said condition signature differs from said normal signature by more than a predetermined threshold.

10 18. A data processing system for monitoring the health of a system, comprising:

data acquisition means for acquiring a plurality of condition indicators from said system at each of a plurality of times defining successive intervals of at most
15 1 sec duration, said condition indicators including (a) a plurality of vibration measurements or (b) one or more vibration measurements and one or more performance parameter measurements;

processor means for constructing a condition signature
20 from said condition indicators and for predicting a normal signature corresponding to a condition signature for a healthy system;

comparator means for comparing said condition signature with said normal signature; and

25 registration means for registering an event if said comparator indicates that said condition signature differs from said normal signature by more than a predetermined threshold.

30 19. A method of synchronising two or more data streams, each data stream comprising a series of sequentially acquired data elements, the method comprising:

associating a time stamp with each data element of each stream, the time stamp identifying the time of

T.D.50.20-80025350

acquisition of the data element on the basis of a clock common to all data streams;

selecting a first data element from a first stream and inspecting its time stamp;

- 5 conducting a search of the data elements of the or each other stream to identify the data element in the or each other element having an associated time stamp closest to that of the selected element of the first stream; and
- 10 marking said identified data element of the or each other stream and said selected element of the first stream as being synchronised with one another.

20. A method according to claim 19, wherein the data element acquisition rate of the first stream is lower than
- 15 the acquisition rate of the or each other stream.

21. A data processing system for synchronising two or more data streams, each data stream comprising a series of sequentially acquired data elements, comprising;

- 20 means for associating a time stamp with each data element of each stream, the time stamp identifying the time of acquisition of the data element on the basis of a clock common to all data streams;

- 25 means for selecting a first data element from a first stream and inspecting its time stamp;

- 30 means for conducting a search of the data elements of the or each other stream to identify the data element in the or each other element having an associated time stamp closest to that of the selected element of the first stream; and

 means for marking said identified data element of the or each other stream and said selected element of the first stream as being synchronised with one another.

095500070501